REPORT OF THE SUB-COMMITTEE ON ANATOMY TO THE COUNCIL ON MEDICAL EDUCATION OF THE AMERICAN MEDICAL ASSOCIATION.

APRIL, 1909.

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In the Record, Vol. II, No. 9, Dec., 1908, p. 425, a brief statement was made of the purposes of the committee of one hundred appointed by the Council on Medical Education of the American Medical Association to consider the medical curriculum in schools demanding at least one year of college work in physics, chemistry, biology and language for matriculation. The sub-committee on anatomy consisted of Professors G. A. Piersol, F. P. Mall, I. Hardesty, G. S. Huntington, J. P. McMurrich, A. C. Eycleshymer, T. G. Lee, C. M. Jackson, G. Carl Huber and C. R. Bardeen, chairman. The questions outlined in the Record were discussed by correspondence with the various members of the committee and were considered at an informal conference held at the time of the December meeting of the Association of American Anatomists. In response to the notice in the Record replies were received from several anatomists, including Professors A. W. Meyer, B. L. Myers and Robert Bean. Prof. Irving Haynes furnished an extensive account of the work in gross anatomy at Cornell. From the data thus gathered a report on the teaching of anatomy was compiled, submitted to the various members of the sub-committee on anatomy, revised, and presented in abstract to a joint committee composed of the chairmen of the various divisions of the Committee of One Hundred and of the members of the Council on Medical Education. It was, in part, finally read at the annual Conference on Medical Education held by the Council on Medical Education at Chicago, April 5.

Two meetings of the joint committee were held, one at New York, in December, and one at Chicago preceding the conference.

Practically the whole session at each meeting was spent in trying to adjust, to a four-year curriculum of reasonable proportions, the claims of the various sub-committees for time for their various subjects. The Council started out with the assumption that in general the medical curricula of our medical schools are overcrowded and are not in all cases well proportioned. The various sub-committees were therefore requested to consider the minimum number of hours in a 3600-hour curriculum which should be devoted to the subjects they were appointed to consider. At the first meeting of the joint committee it was found that the total number of hours requested by the various sub-committees instead of amounting to 3600 hours, amounted to over 4500 hours. It was not found possible to get a general agreement concerning the reduction of the number of hours devoted to each subject so as to formulate a 3600-hour curriculum and it was decided to proceed on the basis of a 4000-hour curriculum. A provisional number of hours, on this basis, was allotted to each subject. The provisional schedule was referred back to the various sub-committees and at the second meeting of the joint committee a schedule amounting to 4345 hours was discussed. This was finally reduced to 4100 hours. The 4100 hours were regarded as the maximum number that should be definitely prescribed for a four-year course. Instead, therefore, of defining a minimum curriculum the joint committee finally determined a maximum curriculum. It was the unanimous opinion of all present that it would be a grave mistake to try to prescribe identical curricula for all medical schools; that freedom in schedule making in different schools is an imperative necessity if progress is to be made and that the schedule adopted by the joint committee is meant merely to be suggestive. At best it is a compromise arrived at between the chairmen of the ten sub-committees and the members of the Council during two brief meetings.

It may be of interest to compare the schedule finally adopted by the joint committee with the provisional schedules of this committee, with the present schedule of the Association of American Medical Colleges and with the revised schedule proposed at the last annual meeting of the Association.

TABLE I.

NUMBER OF HOURS ALLOTTED TO THE CHIEF SUBDIVISIONS OF THE MEDICAL CURRICULUM, IN

SUBJECTS	Schedule Assoc. Amer. Medical Col.	Proposed Revised Schedule	Schedule N. Y. Meet. Joint Com.	Prov. Schedule Chic. Meet. Joint Com.	Final Schedule Chic. Meet. Joint Com.
Anatomy, including Histology and Embryology	630	750	600	760	700
Chemistry*	300	420	300	300	280
Physiology	300	240	250	270	250
Bacteriology and Pathology	380	405	500	500	500
Pharmacology and Materia Medica	120	185	120	160	160
Therapeutics	90	?	80	80	80
Medicine, including Pediatrics and Nervous Diseases	1040		950	945	890
Surgery (including G—U)	600		650	700	650
Obstetrics	160		200	280	180
Gynecology	160		†	†	60
Eye, Ear, Nose and Throat	120		150	150	140
Dermatology and Syphilis	40		90	90	90
Public Health and Medical Jurisprudence	60		110	110	120
	4000		4000	4345	4100

*In the schedule of the Association of American Medical Colleges, chemistry includes inorganic as well as organic and physiological chemistry. In that of the American Medical Association inorganic chemistry is not included since this is assumed to be required for matriculation.

†Included here with obstetrics.

In the majority of the better medical schools of the country over 800 hours, about a fifth of the curriculum, are devoted to the anatomical sciences. There is undoubtedly at present a desire on the part of those teaching other branches to curtail anatomy so that more time may be given to those branches. The curtailment of anatomy to 630 hours in the 4000-hour curriculum of the Association of American Medical Colleges has, however, not proved satisfactory, and in the new curriculum proposed at the last annual meeting the number of hours for anatomy has been raised from 630 to 750. The 20 per cent. leeway allowed in each subject in the curriculum of the Association of American Medical Colleges makes this 4000-hour schedule elastic when it is taken in the right spirit and not rigidly applied. With 20 per cent. leeway the minimum allowed for anatomy in the new schedule would be 600 hours and the maximum of specified work might be 900 hours. These figures seem to me reasonable.

I believe, however, in a curriculum in which specific requirements are made in as few subjects, and in these subjects in as restricted a manner, as is consistent with a fair breadth of training. It is obviously impossible for the student in four years to become really proficient in each of the great branches included in the medical curriculum. He should gain some conception of the principles underlying each of these branches and should gain real proficiency in some one or two of them. Only thus can he acquire depth of understanding and the habit of thoroughness, only thus can he be made efficiently self-reliant. The twice repeated three months' lecture course of a generation ago had the advantage that it left time to the better students to develop themselves freely and independently during the other nine months. Good men were thus produced in spite of limited facilities. Give the student good facilities for work, freedom and encouragement, and the problem at once becomes not how to get him to work more, but how to prevent him from overworking.

Another advantage of having the required work reduced to a minimum is that it forces the teacher to discriminate carefully between the essential and the non-essential, and to emphasize principles rather than details in the required courses. On the other hand the teacher is forced to keep up a keen, active interest in his science if he is to attract students to his department to do advanced work. He must be an investigator in order to keep up that spirit of scientific enthusiasm which alone makes a laboratory or a clinic attractive.

Believing thus in freedom for the development of the student and of the teacher I took at the first meeting of the joint committee a stand for a schedule of minimum requirements. I suggested a 3000-hour defined curriculum in which anatomy should have 600 hours. In such a curriculum the student who desired could elect other courses in anatomy than those required. The 600 hours in anatomy was acceptable to the chairmen of most of the other subcommittees, but a curriculum limited to 3000 hours was not. The result was a 4000-hour schedule in which anatomy was limited to 600 hours. In such a schedule the student who desired to elect more anatomy would have little opportunity to do so. At the Chicago meeting the amount of time finally allotted to anatomy was 700 hours in a 4100-hour curriculum. I believe 700 hours a fair requirement for anatomy in a 3600-hour schedule permitting of elective studies and work outside of scheduled hours. I believe that in a 4100-hour curriculum where obviously little freedom is allowed for extra work, 700 hours is proportionately too small an amount of time and that 800 hours would be a fairer allotment for anatomy.

The proportionate amount of time which should be allowed anatomy depends upon the relative value of anatomy in medical education. This in turn depends upon the importance of anatomy in developing the capacity to solve the problems presented by disease.

Of the various subjects in the medical curriculum, gross anatomy is the most concrete, the most definite in its relations to practical medicine and the easiest to supply with abundant material. The student in a good course in practical anatomy forms a direct familiar acquaintance with the intricate structure of the human body and becomes skilled in the use of instruments. Familiarity with human structure is essential for physical diagnosis, and hence is fundamental for scientific treatment. The skill gained in dissecting is an aid in every branch of medicine. It is certain that if a student does not dissect enough to acquire skill and does not study anatomy enough to become familiar with the body, infantile and youthful as well as adult, he will be seriously hampered in medical practice.

Microscopic anatomy is important for real understanding of gross structure. It is essential for physiology, pathology and clinical diagnosis. It therefore is, like gross anatomy, of fundamental value in medicine. Its educational value is increased by the fact that for it, as for gross anatomy, an abundant supply of excellent material may be readily furnished the student.

Embryology is scarcely less important. It offers the medical student his best opportunity to get some understanding of the phenomena of growth, the most basal thing in life. It gives abundant opportunity for experimental work.

Neurology is so important that it has acquired the dignity of a separate branch. Since man is so essentially a creature of nerves and brain it is obvious that some real understanding of the structure of the nervous system is essential for the scientific physician.

These fundamental anatomical sciences, gross and microscopic anatomy, embryology and neurology can be readily well taught. They cannot be quickly assimilated. The student must have plenty of time to dissect, to draw, to think over his work, to compare one part with another and a dissected part with cross sections, if he is to acquire familiarity with human structure and to learn to think anatomically. He must have plenty of time to prepare and study microscopic specimens and to compare microscopic with macroscopic structure if he is to get much real benefit from microscopic anatomy. He must have time to watch ova develop into embryos as well as to follow microscopically successive stages of development in prepared specimens if he is to get some understanding of growth. He must devote long hours to patient study if he is to get any real insight into the structure of the central nervous system. If the student has become thoroughly grounded in these branches, he will have a definite and firm foundation upon which to rear an understanding of human medicine. If he has not this foundation he is likely to lack security and stability in his subsequent studies and work.

The statement is sometimes made that knowledge of function is more important to the physician than knowledge of structure, and that therefore anatomy should be reduced in amount in order that more time may be devoted to physiology. One can study human anatomy in the laboratory. Opportunities for the study of human physiology in the laboratory are limited. The bedside during the study of clinical medicine often offers more. Even mammalian physiology must at present be studied by students in a greatly restricted way in most schools, since public opinion has not yet been educated to the value of vivisection in medical training. In this respect physiology stands to-day almost where human anatomy did a century ago in the times of body snatching. Could laboratory courses in mammalian physiology be offered with perfect freedom as to use of animals, it is possible that many anatomical facts now learned in the dissecting room could be picked up incidentally as a part of physiological experiments. As it is, a considerable part of physiology consists of deductions from anatomical facts, and much of the rest consists of knowledge gained by experiments not practical for repetition by the student. The field of practical physiology is at present very limited so far as laboratory work for medical students is concerned.

On the other hand in the courses in the anatomical laboratory the physiological aspects of the subject may with great advantage be emphasised. In embryology the physiology of growth may be taken up. In the study of the skeleton, muscles and joints considerable attention may be given to the simpler mechanics of motion. In the study of the gross and microscopic structure of the viscera and the nervous system many physiological data may be learned. Thus a good groundwork for the more technical aspects of physiology is gained. The committing of text-book detail to memory should be given up in favor of these broader aspects of the subject.

I believe, however, that what we as anatomists should stand for is not the retention of a large number of required hours for the anatomical sciences in the medical curriculum, but for a curriculum in which in each of the fundamental branches there is small amount of required work and abundant opportunity for the student to do much more than the required work. The value to the physician of thorough work in the anatomical sciences will certainly manifest itself where such a curriculum prevails and will insure abundant enthusiastic work in anatomy. We must not, on the other hand, permit anatomy to be unduely curtailed by too extensive time requirements in other departments.

In the following report of the sub-committee on anatomy I omit the introduction, which covers much of the ground just reviewed. I also omit some details not likely to be of interest to professional anatomists. The report in full, together with a summary of the opinions of the individual anatomists who contribute to it, is to be published by the Council on Medical Education.

REPORT OF SUB-COMMITTEE ON ANATOMY TO THE COUNCIL ON MEDICAL EDUCATION OF THE AMERICAN MEDICAL ASSOCIATION.

(*A*) *Essential pre-requisites for the anatomical sciences of the medical course.* Required preliminary work of college grade in physics, chemistry, biology and modern language is of especial advantage to anatomy. Anatomy comes at the beginning of a student's course in a medical school, and unless the student has had adequate preliminary training he must first learn how to work before he can begin to make headway in the science. The well-prepared student can do more intelligent work a few weeks after he enters the course than most ill-prepared students can toward the end of the course. The latter are apt to become lost in a maze of detail from which they can derive no meaning. Two years of preliminary college work is far preferable to one year.

Of the preliminary courses the one most directly important for anatomy is a laboratory course of college grade in biology. A well-equipped laboratory is essential for an adequate course. There should be facilities for keeping living plants and animals of various types and the equipment should include an outfit for teaching the microscopic as well as the gross anatomy of plants and animals.

While the course should include some training in botany, the main stress should be laid upon zoology. Courses in comparative anatomy and in comparative embryology are advisable, but not necessary. The physiological as well as the morphological aspects of plants and animals should be emphasized. If the student studies the structure of the lower animals with especial reference to their activities he will subsequently find it the easier to take up the study of human structure from the standpoint of function, the standpoint of greatest importance to the physician.

(*B*) *The place of the anatomical sciences in the medical curriculum.* The first half of the first year of the medical curriculum should be devoted chiefly to gross anatomy and to histology. These subjects should, so far as possible, be co-ordinated. In the second half year histology may be followed by neurology and embryology. Gross anatomy may be continued throughout the second half of the first year or may be taken up again in first half of the second year. Topographical and applied anatomy may be taught in the second and subsequent years of the course. The majority of the committee believe that the required osteology, dissection, histology, neurology and embryology should be completed during the first year, leaving the second year for topographical and applied anatomy and elective work.[1]

(*C*) *Required and elective subjects.* Courses in gross human anatomy and in histology should be required.[2] Courses in embryology, neurology and topographical anatomy may be elective in an elastic curriculum, but should constitute a specific part of a 3600- to 4000-hour defined curriculum. If courses in embryology, topographical anatomy and neurology are not required, the elements of these subjects should be included in the courses in histology and gross anatomy. Various advanced and special courses may be offered as electives. It is certain that no department of anatomy can meet the minimum requirements for medical students if it is not prepared to give much more than minimum opportunities for meeting these requirements.

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[1] Professors McMurrich and Piersol believe some dissection should be required in the second year. Professor Hardesty would place neurology in the second year.

[2] In addition, Professor Piersol would require courses in embryology, neurology and applied anatomy. Professor Eycleshymer would require a course in embryology. Professor Hardesty would require one in neurology.

When the medical school is fortunate enough to be a real and integral part of a university the anatomical department, or institute, may well provide not only courses for medical students, but also premedical courses in comparative anatomy and advanced courses for zoologists, and the work of the university in vertebrate anatomy may be concentrated in this department. Such a department should be centrally connected with the medical school, but should have close affiliations with other colleges and departments. Concentration of this kind adds both to economy and efficiency.

The work offered may comprise courses in

(a) Comparative vertebrate anatomy.

(b) Human and comparative osteology, including special provision for courses for dental students and for students of anthropology and paleontology.

(c) Dissection and systemic human anatomy.

(d) Topographical anatomy.

(e) Anatomy as applied in medicine, surgery and the specialties.

(f) Microscopic anatomy and histology, human and comparative.

(g) Embryology, human, comparative and experimental.

(h) Neurology, human, comparative and experimental.

(i) Anatomical technique: (1) Gross, including injections, corrosions, etc.; (2) General microtechnique; (3) Special technique (blood, etc.); (4) Illustrative work, including drawings, reconstruction methods, etc.

(j) Investigation of anatomical problems, including methods of looking up the literature on a subject.

(k) Seminars, discussion of advances in anatomy.

(l) History of the development of the anatomical sciences.

(m) Artistic anatomy.

While an "ideal" anatomical institute with a director and provision for all the branches mentioned is desirable, it is not essential for the teaching of anatomy in a medical school. It is, however, essential that the courses in gross anatomy should be closely co-ordinated on the one hand with those in microscopic anatomy and embryology, and on the other hand with topographical and applied anatomy. It is also essential that in addition to the work required of every student there should be elective courses and opportunity for advanced work.

(*D*) *Qualifications of instructors.* The supervision of work in a department of anatomy in a medical school should be in charge of persons who have had a thorough professional training in the various branches of anatomy and who have demonstrated ability in teaching and research. They should have acquaintance with anatomy as applied to medicine and surgery. They should devote their entire time to teaching and investigation, and should be provided with ample time and facilities for doing both. The traditional bad name for dulness which anatomy has born among medical students in this country has been largely due to the fact that it has too often been taught by men who have known it only as a dead science. Unless the teacher is playing at least a small part in the growth of the science he is teaching he is not likely to have an intimate acquaintance with its more vital aspects. The teacher should therefore have opportunity to devote himself to investigation. On the other hand it is important that the teaching in the main fundamental courses and especially the laboratory work, including dissection, be directly in charge of the leading members of the staff and not intrusted to inexperienced assistants. In addition to the professor in charge there should, in general, be enough instructors and assistants to provide one for each twelve to fifteen students in a laboratory course. A strong leader may get along with a smaller number of assistants, but an adequate teaching force is essential for thorough efficient work.

While the fundamental work should be directly in charge of the leading members of the staff, many of the elective courses can be put into the hands of less experienced instructors. It is desirable that each instructor give an independent course of this nature, since it serves to show his capacity and aids in his development as a teacher. If successful, a young teacher may inspire much wholesome enthusiasm in his students.

Courses in applied anatomy may be taught by competent clinicians, but should be taught by them in the anatomical department.

(*E*) *Methods of instruction.* The chief essential is the able instructor, professionally trained in anatomy. Various methods of instruction will yield good results when employed by capable teachers. Courses should be arranged so that the student may concentrate the greater part of his energies on the anatomical sciences during the period when he is mastering the essential principles of human anatomy. This so-called "concentration method" was urged half a century ago by Von Baer and has since been recommended by several of the greatest teachers of anatomy, including Waldeyer (see Mall, "On the Teaching of Anatomy," Anatomical Record, 1908).

Abundance of good material is necessary. The equipment may be simple, but should be adequate. Lectures and quizzes may be utilized according to the pedagogical ideals of the instructor, but should be ancillary to the laboratory work. The student, however, should not be allowed to content himself with mere mechanical laboratory work and with committing details to memory. He should get some understanding of general principles, some insight into methods of classification, some idea of the development of anatomy as a science and some knowledge of the relations of the science to medicine. He should gain concrete ideas of structure so as to become able to "think anatomically." He should be made to feel that he is studying an intricate and delicate mechanism which subsequently he will be called upon to set right when it gets out of gear. To do this he must gain a thorough understanding of biological mechanisms in general and of the human mechanism in particular.

Careful, thoughtful dissection of the human body is the chief essential of the work in gross anatomy. Atlases and text-books should be kept close at hand by each student, and he should frequently turn to these for information and guidance. In most of the better American anatomical laboratories the method of coordinate systemic dissection is adopted. The skin is first removed and then the superficial fascia. In the latter the superficial nerves and blood vessels are carefully studied. In the dissection of the deeper parts the vascular and peripheral nervous systems are worked out in conjunction with the organs to which they are distributed. While fat and areolar tissue are removed freely the attempt is made to keep the more definitive structures in as near their natural relations as possible. The text-book, models, special preparations and charts, recitations and the final study of the dissected part are relied upon to give the student a clear conception of each of the great organ systems. A brief study of osteology may precede the dissection, but during dissection the student is constantly referred to the skeleton as a topographical basis and thus he becomes better and better acquainted with it. At the end of the dissection the soft parts are removed and the articulated skeleton is studied. Reference to cross sections during the course of the dissection is a great aid in emphasizing structural relations.

In the course in microscopic anatomy it is usual to study a fairly extensive series of microscopic sections from the chief organs of the human body. In addition to this, in the better laboratories, fine dissection of fresh and hardened tissues and organs, under low as well as high magnification, forms an important part of the work. The aim is made to co-ordinate carefully the structure revealed by the microscope with the gross anatomical structure of tissues, organs and systems. The dissection of a small mammal or an embryo may be utilized to co-ordinate the various organs and systems with the body as a whole. The elements of microscopic technique should be taught, but the student's time should not be wasted by too great a devotion to routine mechanical procedures.

In embryology the work may begin with a study of the general processes of vertebrate development as illustrated by the eggs of the frog and the chick. For medical students, however, a relatively large part of the course should be devoted to organ differentiation and histogenesis in mammals and man. Some experimental embryology should be included in the course. Regeneration in some of the lower forms may also be studied.

In neurology careful dissection of the formalin hardened human brain and cord should be associated with the study of a good series of microscopic sections of the central nervous system. Study of the organs of special sense may form a part of the course in neurology. The study of microscopic sections of the eye, ear and nose should be correlated with dissection of the organs of some mammal.

In topographical anatomy cross sections and special preparations of formalin hardened bodies should occupy the chief attention of the students. Regional anatomy studied on the living model adds much to the interest of such a course.

Drawing is a valuable aid in stimulating the attention and sharpening the powers of observation of students of anatomy. It is commonly required in courses in microscopic anatomy. Simple semi-diagrammatic drawings, if accurate, are equally valuable requirements for courses in gross anatomy. Elaborate drawings, on the other hand, are apt to involve too much thoughtless expenditure of time in mere mechanical procedures. Clay modeling is found by some teachers of much value, especially in the study of osteology. It is apt, however, to involve the risk mentioned in connection with elaborate drawings.

(*F*) *Necessary laboratory equipment.* Under equipment for the department of anatomy are included: (a) quarters, (b) furniture, apparatus and supplies, (c) models and charts, (d) special preparations and (e) library.

(a) *Quarters.* Ample space should be provided for practical work in gross human and microscopic anatomy. There should be a lecture room, rooms for the members of the staff, for advanced work, for museum and library, and for storage. Good toilet and dressing rooms should be provided. We may specify in more detail certain of these requirements.

1. Gross human anatomy. Enough laboratory space should be provided to enable the student to do careful dissecting. Arrangements should be made to prevent disturbance of a dissection during periods when the dissector is not in the room. The rooms should be finished, furnished and cared for in a manner to inspire a sense of refinement in the student. A series of small dissecting rooms,

accommodating from one to three or four dissecting tables, is now preferred by many instructors to a single large dissecting room. Quiet, orderly work is thus much fostered. The dissecting room should be provided with hot and cold running water and be furnished with locker space in which students can put their apparatus, books and dissecting room clothing at the end of the day's work. It is desirable, if possible, that these lockers be placed adjacent to, but not in, the dissecting room itself. The dissecting rooms should be well lighted both by sunlight and by artificial light.

There should be rooms for the preparation and preservation of cadavers, and for maceration and cremation of dissected parts.

A valuable adjunct to the dissecting rooms is a study room in which special preparations, models, etc., are kept. Such a study room should be of ample size for accommodating a class in topographical anatomy.

2. For microscopic anatomy and embryology well lighted laboratory space should be provided. It is desirable, but not absolutely essential, that the major part of the light come from the north. The laboratory should be sufficiently large to provide well lighted space for all students in it at any given time. The work in microscopic anatomy and embryology lends itself more readily than gross human anatomy to teaching classes in sections which in turn use the same laboratory.

A study room in which a reference collection of microscopic specimens, special preparations and models are kept, is a valuable adjunct to the general laboratories for microscopic anatomy and embryology.

In connection with these laboratories there should be a room in which the material for the class is prepared. Such a room should be well lighted, be provided with gas and hot and cold water, and with a good equipment for microscopic technique.

3. If desired, lectures in anatomy may be given in the laboratories, so that a special lecture room is not absolutely essential. It is, however, a convenient adjunct. The seats should be so arranged that demonstrations may be readily observed from any part of the room.

4. The members of the staff should be provided with private quarters suitable not only for office work, but also for carrying on scientific investigation. Other rooms in which advanced work in anatomy and research can be carried on are a valuable adjunct. The preparation rooms can, however, be utilized for advanced students.

A photo-micrographic dark room is of great value. This should be provided with a photo-micrographic outfit and a camera and lens for copying and enlarging, making lantern slides and photographing gross specimens.

5. In addition to the working collections provided for in the study rooms mentioned above, a large museum containing preparations illustrating human and comparative anatomy is an important, if not absolutely essential, adjunct to an anatomical department. It should contain merely well selected specimens and not be "a reservoir for dumping a miscellaneous lot of stuff."

6. The department should be supplied with ample library facilities. Unless the general library of the medical school is readily accessible from the quarters occupied by the anatomical department, a special room should be set aside for a departmental library.

(b) *Furniture, apparatus and supplies.* There should be an ample supply of furniture, including book-cases, museum-cases and cabinets, to accommodate the students and the members of the staff.

The apparatus required is in part general and in part special. It should be sufficient not only for class room work, but also for making good anatomical preparations, for advanced work and research.

For gross human anatomy there should be enough disarticulated skeletons to provide the students freely with bones. There should be an ample supply of well-embalmed bodies, so that each student may be furnished half a body for dissection. Six students are as many as should dissect upon a single body at one time. There should be a sufficient supply of cross sections to offer every student an opportunity to use them for the study of regional anatomy.

The dissecting rooms should be provided with dissecting tables of convenient height and width and with reading stands for holding text-books. The students should be furnished with chairs or stools, so that they do not have to stand all the time they dissect. They should be given wrapping cloth and preserving fluids with which to keep the parts dissected in good condition. The study room should be supplied with metallic boxes or other receptacles for moist and wet specimens, including cross sections, special preparations and dissected parts.

In the preparation room there should be an injecting apparatus of such a nature that the fluid may be forced into the body under an even pressure. This is afforded either by a water blast or by a gravity tank. The room should contain one or more embalming tables and a tackle and clasp for handling cadavers. The room for preserving cadavers may be provided with a cold storage apparatus, but this is not necessary unless a large number of bodies are handled. If the bodies are well embalmed they may be preserved in vats or metal-lined boxes or in water-proof sacks.

The apparatus for maceration of parts may be simple, but should be well ventilated. A furnace in which forced draft can be obtained either by gas or by other means is necessary for the proper cremation of parts.

For microscopic anatomy and embryology there should be a good supply of prepared and mounted sections which can be loaned students or demonstrated to them. In addition there should be a supply of material which may be given the students. There should be a laboratory assistant to prepare sections for the classes, including all steps in technique except mounting of specimens on the slides. The members of the class are thus provided with specimens of uniform excellence. It is probably a mistake to try to give students to keep specimens requiring difficulty in preparation. Specimens of this nature should be merely loaned for study. There should be an adequate supply of compound and dissecting microscopes. The student should provide himself with a set of simple laboratory instruments.

For embryology, in addition to the apparatus required in histology, special sets of serial sections of embryos in various stages of development and a collection of mammalian and human embryos and fetuses, in part dissected, are essential. Frogs' eggs and pig embryos preserved in formalin make excellent material for the study of the grosser features of early development. For the study of the development of the hen's egg an incubator of some sort is required.

For neurology a special section cutter for the brain is of great value.

(c) *Models and charts.* For gross human anatomy models of papier maché, of plaster and of wax are of considerable value. Such models are essential for the study of structures difficult to appreciate in gross dissection because of their minuteness, such as the finer structure of the larynx, brain, eye, ear, tongue, central nervous system and the nerves of the head. Models illustrating the comparative anatomy of various structures are also of value.

In histology models are useful in illustrating the minute structure of intricate regions, such as the organ of Corti and various parts of the central nervous system. They are also of great value in giving an idea of the third dimension of various other microscopic structures, but unfortunately accurate models of this kind are not yet readily obtained.

In embryology the scarcity of material makes it impossible for the student to get first hand knowledge of the structure of young human embryos. The Ziegler models therefore form an indispensable adjunct to a course in human embryology. Models illustrating the development of the frog, chick and other lower vertebrates and of various organs are likewise of great value.

Charts and lantern slides are an important adjunct to lectures in embryology, histology, neurology and gross anatomy.

(d) *Special preparations.* To illustrate gross human anatomy there should be numerous special preparations. These should include skeletal preparations, cross sections of the body, and special dissections of various parts of the body.

The skeletal preparations should include well articulated male and female skeletons, adult, youthful, infantile and fetal; special preparations of the skull and bones of the head, and fixed and pliable preparations of the joints. Pathological specimens illustrating fractures and abnormalities of the bones and joints are of considerable value.

The cross sections should pass through the body in various planes, and should illustrate infantile and youthful as well as adult conditions.

The special dissections should include regional preparations of the head, neck and extremities, and dissections of the eye, ear, nose, mouth, larynx, pharynx, cranial nerves, biliary system, the genito-urinary system and the central nervous system. There should be a series of preparations illustrating the viscera in infancy and youth. Specimens illustrating the distribution of lymphatics are of importance owing to the difficulty of dissecting these in the average cadaver.

For organology and histology corrosion preparations of the lungs, liver, spleen, kidneys and other organs are of great value. For embryology specimens cleared in caustic potash and glycerine are useful in illustrating the development of the skeletal system and in case of specimens which have been previously injected in illustrating the development of the vascular system and other organs.

(e) *Library.* The anatomical department should be provided with a library which should include the standard monographs and journals devoted to the subject. As already mentioned, if the main library of the medical college is not readily accessible to the quarters occupied by the department of anatomy the latter should have a special library in which files of current journals, text-books and works of reference are kept. Such a library should be readily accessible to students and members of the staff. In general, valuable sets of periodicals are best kept in the main library, where, as a rule, they will receive better care.

(*G*) *Auxiliary facilities.* See under F.

(*H*) *The proportion of didactic to laboratory teaching.* The committee is unwilling to set a fixed standard. Laboratory work should consume the major portion of the time devoted to each of the anatomical sciences. Lectures may perhaps justly take a greater portion of the time in courses in embryology, histology, neurology and applied anatomy than in gross anatomy.

(*I*) *The proportionate number of hours to be devoted to the anatomical sciences in a 3600- to 4000-hour curriculum.* In most American medical schools of the better grade from 800 to 900 hours, about a fifth of the curriculum, are devoted to the anatomical sciences. In the present schedule of the Association of American Medical Colleges 630 hours out of 4000 are allotted to anatomy, but the committee on medical education of that association has recommended that this be increased to 750 hours. Your committee believes that 700 hours in a 3600-hour curriculum or 750 to 800 hours in a 4000-hour curriculum would represent a fair proportion of time for anatomy. The majority of the committee believe in a medical curriculum in which the required work is kept at a minimum which will give students considerable time for elective work and independent study. They would prefer to see the defined required work for the whole curriculum kept within the original estimate of 3600 hours.[3]

The time allotted to anatomy will be sub-divided according to the arrangement of courses. Thus when a separate course in neurology is devoted to the gross and microscopic anatomy of the central nervous system and organs of special sense an equivalent amount of time may be taken from the courses in gross and microscopic anatomy. In the present schedule of the Association of American Medical Colleges 90 hours are given to histology, 90 to embryology, 30 to osteology and 420 to gross anatomy. In the schedule recently proposed 540 hours are given to gross anatomy, 135 to microscopic anatomy and 75 to embryology. The following sub-division of time agrees approximately with the majority of the schedules proposed by the various members of your sub-committee on anatomy for a 3600-hour curriculum.

In a 700-hour schedule the course in topographical anatomy should be taken from this list and ten hours added to the course in gross anatomy.

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[3] Professors Hardesty and Jackson prefer a curriculum of at least 4000 hours. Professor Piersol believes it difficult to keep within a 4000-hour schedule, but that in such a schedule anatomy should have 871 hours, of which 60 should come in the third year.

Gross Anatomy	370 hours
Histology	140 hours
Neurology	90 hours
Embryology	90 hours
Topographical Anatomy	70 hours
Total	760 hours

(*K*) *Cost of maintaining an anatomical department.* A few years ago the chairman of the sub-committee on anatomy obtained from those in charge of the departments of anatomy in several of our leading universities an estimate of the cost per year of maintaining their departments. Below a summary is given of the average cost of maintenance of the anatomical departments of five endowed and of four state universities. When gross and microscopic anatomy are taught in separate departments the budgets of the two departments are added together in making up the estimates. The average number of students in each class at the five endowed universities was 85, in the four state universities 80.

TABLE SHOWING THE AVERAGE YEARLY EXPENDITURES FOR THE ANATOMICAL DEPARTMENTS.

	Salaries.	Technical service.	Apparatus, etc.	Total.
At five Endowed Universities.	14,000	2,000	3,600	19,600
At four State Universities. . .	8,000	1,000	2,600	11,600

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